UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

Technical Conference on Electrification And the Grid of the Future	))	Docket No. AD21-10-000

Statement of Pamela MacDougall
On Behalf of the Environmental Defense Fund

Thank you for the opportunity to provide information to the Federal Energy Regulatory Commission (Commission) on how accelerating electrification of many aspects of our economy and lives will affect and influence Commission-jurisdictional rates and practices. Electrification of transportation and building heating, while a key component of achieving climate goals, also offers a number of potential reliability, resilience, and economic benefits to the electric system. However, unlocking the benefits of electrified resources and other such Distributed Energy Resources (DERs) will require intentional technical and market design to enable DERs to be integrated into power markets, system planning and operations to ensure they receive appropriate compensation for the benefits they provide to customers and the system. Through recent actions, particularly Order No. 2222, the Commission has started a process for the needed integration. However, Commission actions such as opening this docket are crucial next steps to elicit more extensive information and evidence necessary to ensure increasingly effective, efficient, resilient and competitive electric markets while accelerating the economic and policy-driven transition to clean energy technologies free of Commission-jurisdictional barriers.

The Environmental Defense Fund (EDF) supports using the power of markets to speed the transition to clean energy resources and works to facilitate cost-effective and efficient energy market designs that encourage investment to modernize the energy grid so that it can support the ongoing deployment of renewable energy resources and DERs. This statement briefly describes the current state and potential of electrification and DER deployment and the need to unlock the benefits of DERs to support the evolving electric grid. It then offers a set of recommendations to improve market design and better facilitate DER integration.

Electrification will play a major role in the evolution of the energy sector to meet climate goals and unlock the benefits of new and developing energy technologies. DERs, including load side management, are entering markets in the U.S. at an accelerating rate, driven by economics, climate action, and consumer choice. Proper integration of DERs has the potential to help lower grid and energy costs, while reducing greenhouse gases, by leveraging existing carbon-free assets more efficiently and driving effective deployment of electrification and other DERs.

With states committing to electrification in the transportation sector, through policies such as the California Advanced Clean Truck Rule[1] and the memorandum of understanding signed by 15 states committing to exclusively zero-emissions trucks be sold by 2050,[2] there will be an exponential uptake of electric vehicles and therefore energy demand on the grid.

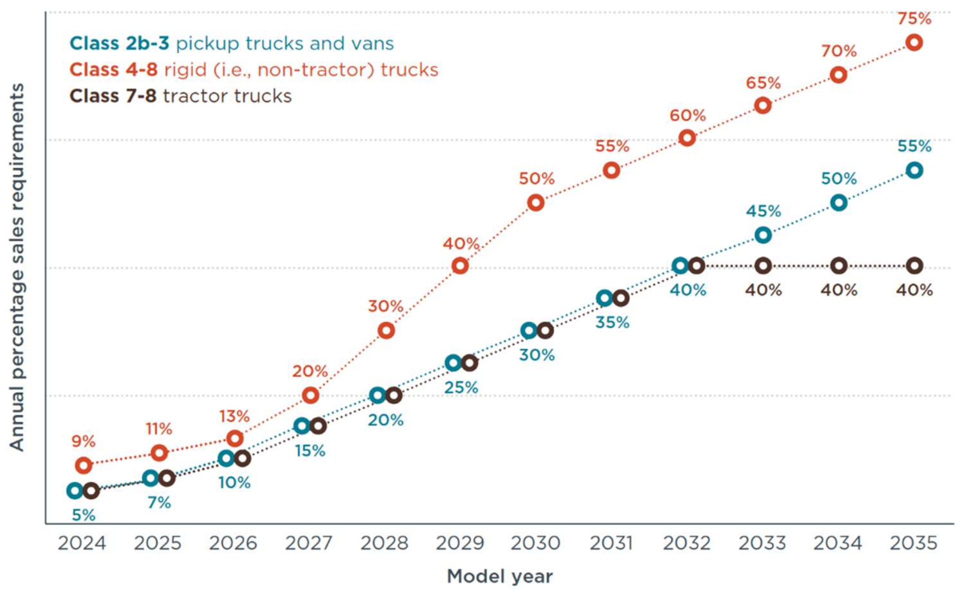

Figure 1: Zero-Emission Vehicle sales percentage by vehicle group and model year for the California Clean Truck Rule.[3]

Further, a number of states have committed to significant reductions in gas usage in the building sector. For example, New Jersey's Energy Master Plan calls for electrifying 90 percent of New Jersey's buildings by 2050.[4] Maine is also paving the way to electrification with its Climate Action Plan calling for the installation of at least 100,000 heat pumps by 2025 with at least 245,000 homes using heat pumps by 2030.[5] At least 25 states, as well as Puerto Rico and

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[1] 13 CCR 1963 – 1963.5 and 13 CCR 2012 – 2012.2, available at https://ww3.arb.ca.gov/regact/2019/act2019/fro2.pdf.

[2] Multi-State Medium- and Heavy-Duty Zero Emission Vehicle Memorandum of Understanding, available at https://www.nescaum.org/documents/multistate-truck-zev-governors-mou-20200714.pdf/.

[3] International Council on Clean Transportation, California's Advanced Clean Trucks regulation: Sales requirements for zero-emission heavy-duty trucks (July 20, 2020), available at https://theicct.org/publications/california-hdv-ev-update-jul2020.

[4] New Jersey Board of Public Utilities, Energy Master Plan (2019), available at https://www.nj.gov/emp/docs/pdf/2020_NJBPU_EMP.pdf.

[5] Maine Climate Council, Maine Won't Wait: A Four-Year Plan for Climate Action (December 2020), available at https://www.maine.gov/future/sites/maine.gov.future/files/inline-files/MaineWontWait_December2020_printable_12.1.20.pdf.

the District of Columbia, have also established greenhouse gas reduction targets that will in many cases require substantial electrification.[6]

This transformation will increase total electric usage but will also offer the opportunity to manage the newly electrified resources in ways that benefit both the end use customer of the resource and more broadly all customers on the grid. Making use of the load flexibility these resources offer, coupled with the increased deployment of DERs such as solar and stand-alone storage, will help to ensure an effective transition to a low-emission, reliable electric grid at the lowest possible cost.

This ongoing transition to a more distributed grid is resulting in larger percentages of variable energy resources (especially rooftop solar), and the development of locally, temporally variable storage and load-management resources. These resources are characterized by greater forecasting uncertainty – whether driven by weather, human behavior, or visibility of the resource to system operators if the resource is located behind the meter.

In California, the commonly known "duck curve," seen below, demonstrates the impact of renewable energy on net load. This has resulted in a surplus of solar generation mid-day followed by an electric demand peak in early evenings.

[6] Center for Climate and Energy Solutions, U.S. State Greenhouse Gas Emissions Targets, https://www.c2es.org/document/greenhouse-gas-emissions-targets/.

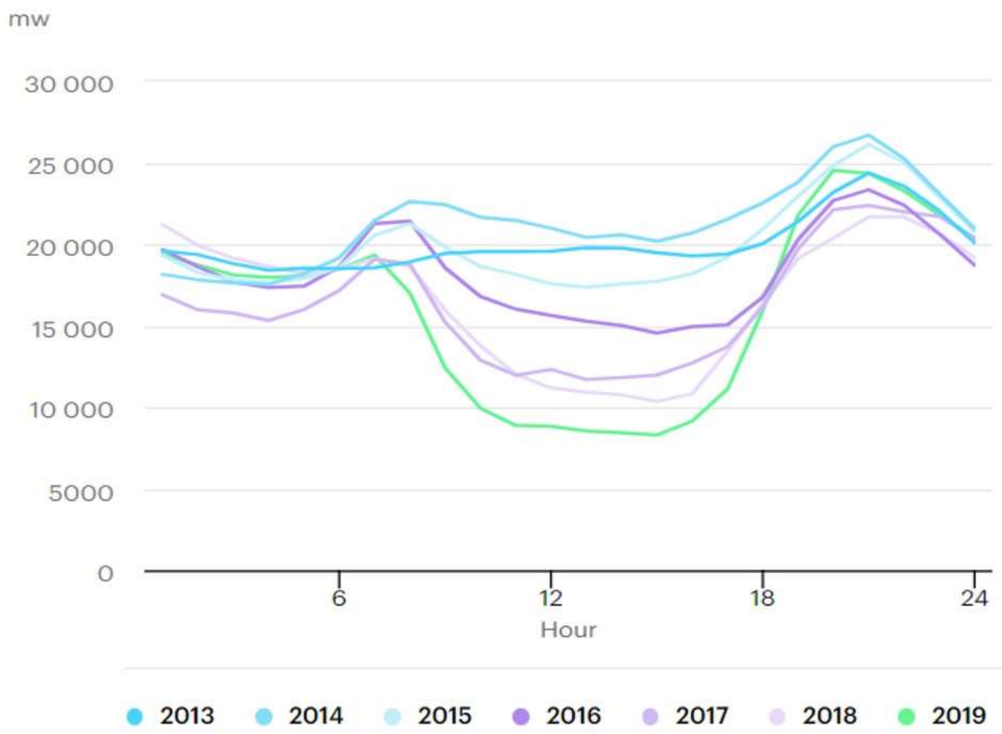

Figure 2: CAISO's duck curve.[7]

Appropriate use of the load flexibility offered by electrified resources, including electric vehicles, could help balance this variability and optimally use the resources in the system. For example, a recent study done by Gladstein, Neandross & Associates demonstrated the potential benefits of managed charging, as well as on-site DERs, for electric heavy-duty trucks.[8] The study found that peak load for the charging of a fleet of 50 heavy duty trucks could be reduced by about 6 MW through the use of managed charging coupled with on-site solar and stationary storage, as compared to unmanaged charging. Scaling this result to California's entire transportation electrification goals, including leveraging the load flexibility of fleet charging and their on-site DERs, can impact peak load on the order of GWs, which among other benefits could reduce local and regional resource adequacy requirements. While electrification will significantly increase total load, active management of these resources can both reduce the overall peak as well as provide load when there is an abundance of energy from utility-scale wind and solar resources.

Looking at electric vehicles alone, the amount of load flexibility is significant. A recently released study by the Midwest ISO shows the untapped potential of load flexibility as a DER resource in the wholesale markets. This study evaluated the impact of expected electrification of both medium and heavy-duty vehicles (MHDVs) as well as passenger vehicles in their service

[7] IEA, The California Duck Curve (Dec. 19, 2019), available at https://www.iea.org/data-and-statistics/charts/the-california-duck-curve

[8] Gladstein, Neandross & Associates, California Heavy-Duty Fleet Electrification Summary Report (March 2021), available at http://blogs.edf.org/energyexchange/files/2021/03/EDF-GNA-Final-March-2021.pdf

territory. A key factor in this study was determining the potential flexibility of these vehicles when applying managed and bidirectional charging tactics to mitigate ramp and peak load. The figures below depict the hourly slack capacity of MHDVs and passenger or light duty vehicles (LDVs) for a single day, shown in dark blue. In light blue is the corresponding optimized vehicle to grid charge (positive value) or discharge (negative value). This shows that at any given hour this additional load can provide a minimum of 10 GW of combined ramp up capacity and just under 10 GW of ramp down or generation capacity using the flexibility of EV charging alone. This would be even greater when combined with other on-site DERs.

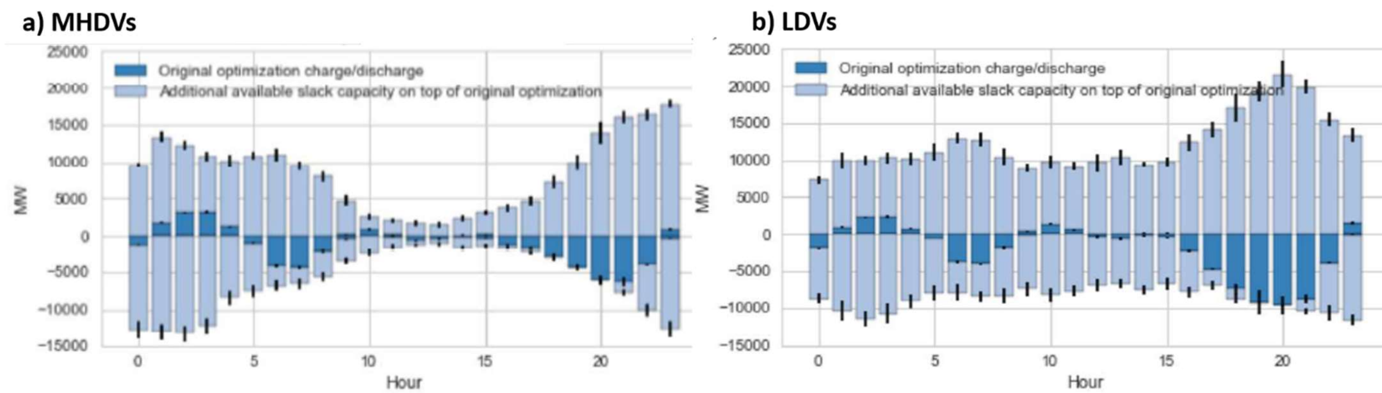

Figure 3: Hourly MW of deployable flexibility for a) MHDVs and b) LDVs in original optimization (dark blue) and additional available slack capacity on top of original optimization (light blue) .[9]

This load flexibility also comes at a fraction of the cost of traditional fixed battery storage. A study by Lawrence Berkeley National Lab[10] shows that managed charging of EVs—modulating when and at what rate the EVs are charged— can provide reliable storage at approximately a tenth of the cost of equivalent storage provided by single-purpose, stationary batteries. When scaled to California's projected 1.5 million passenger EVs by 2025, the storage potential of managed charging alone is 1 GW, resulting in savings of ~ $1 billion compared to investments needed for equivalent stationary storage. This number also does not include the thousands of MHDVs such as buses and trucks expected to be electrified it the near future. By leveraging the flexibility of newly electrified resources, stakeholders can significantly reduce grid management costs ultimately, resulting in savings for end-customers.

Over the past few years, the Commission has taken significant steps to remove market participation barriers to these resources. The most significant steps have been Order 841, which cleared the way for transmission grid operators across the country to open their markets to energy storage, including aggregated batteries connected at the distribution grid or behind

[9] Greenblatt, Jeff and Margaret McCall. "Exploring enhanced load flexibility from grid-connected electric vehicles on the Midcontinent Independent System Operator grid" Available at: https://cdn.misoenergy.org/Exploring%20enhanced%20load%20flexibility%20from%20grid%20connected%20EVs%20on%20MISO%20grid543291.

[10] Coignard, Jonathan, et al. "Clean vehicles as an enabler for a clean electricity grid." *Environmental Research Letters* 13.5 (2018): 054031.

customers' meters, Order 845, which enabled interconnection of DERs, and the monumental step forward in September 2020 with Order 2222, which required grid operators to revise their tariffs to ensure DER aggregations can participate in the markets.[11]

While these steps taken by the Commission do move the needle forward for DER integration, DER potential in the United States remains largely untapped on the bulk power system. Most DERs are not integrated into wholesale markets. Those DERs that are integrated typically participate as net-load or demand response resources—an important, but limited role. For example, in PJM, of the estimated 7 GW of distributed generation and storage, only 2 GW were participating in the wholesale market as of 2019.[12] This is likely due in part to limitations on particular types of DERs providing services to the transmission system, which vary among the regional grid operators, and also because DERs may not be able to contribute their full value under current market rules, which were designed around traditional power plants and consumers. To overcome these challenges, new markets rules should be designed with the characteristics of DERs in mind, such as short duration fast response, and should assign equitable value to these types of services.

Further action is needed to ensure these valuable assets are able to offer grid services. The Commission should offer further direction regarding integration of DERs, including newly electrified resources, in the wholesale market and should carefully review implementation of Order No. 2222 to ensure that the potential benefits of DERs are achieved. Specifically, the Commission should ensure that DERs are integrated into wholesale markets consistent with the following recommendations outlined below.

Recommendations

To ensure a modern grid which effectively incorporates beneficial electrification into its grid operation, it is critical that barriers for wholesale market participation of DERs be removed. While Order 2222 is a crucial step forward, additional reforms are needed to ensure DERs are capable of providing grid services. Therefore, I recommend that the reforms include the following components:

1) Allow DERs, including those of third-party ownership, to provide grid services which they are technically capable.

Market entry restrictions and misconceptions of the technology prevent DERs from providing service consistent with their technical capabilities.

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[11] Participation of Distributed Energy Resource Aggregations in Markets Operated by Regional Transmission Organizations and Independent System Operators, Order No. 2222, 172 FERC ¶ 61,247 (Sept. 17, 2020); Reform of Generator Interconnection Procedures and Agreements, Order No. 845, 163 FERC ¶ 61,043 (April 19, 2018); Electric Storage Participation in Markets Operated by Regional Transmission Organizations & Independent System Operators, Order No. 841, 162 FERC ¶ 61,127 (Feb. 15, 2018).

[12] PJM, Distributed Energy Resources Fact Sheet (2019), available at https://www.pjm.com /-/media/about-pjm/newsroom/fact-sheets/distributed-energy-resources.ashx.

For example, electric vehicles, having a physical battery on board, are often limited to demand response or utility-based time variant rates to offer grid services. However, these resources are able to be active participants in the energy markets and provide frequency balancing services,[13] peak and ramp reduction,[14] congestion management,[15] voltage control, and capacity services[16] just to name a few. If resource types are able to respond and provide reliable services, they should be allowed to participate in the market for these purposes.

Further, regarding ownership, a growing trend for large businesses and fleets is to allow a third party to install and operate the charging infrastructure often coupled to behind the meter solar and storage. Under the current interconnection rules, in order to sell into PJM for example, the RTO requires that the owner of the meter (e.g., the business buying the output of a DER) sign a wholesale market participation agreement (WMPA), rather than allowing the owner of the DER to do so. This causes unnecessary barriers to wholesale participation, as signing a WMPA can be a deterrent to installing a DER for many businesses, as it potentially triggers federal jurisdiction by FERC, creating an unknown new regulatory obligation. A third-party financer or the party responsible for the operation and maintenance of the DER should be able to sign the WMPA, as this would streamline the process for consumers and better align the market with common DER financing models.

2) Design market products, such as intraday settlements, to support DER participation.

A lack of financial incentive and commercial opportunity in wholesale markets can deter DER participation. RTO/ISO wholesale service products are often designed from the perspective of large, utility-scale resources whose output can be predicted days in advance. DERs, while proven to be able to provide reliable grid services, are characteristically fast responders, provide short duration services, and often have higher performance uncertainty until closer to dispatch. For example, an aggregator of a managed fleet of delivery vehicles may not have a clear forecast of when each vehicle will be available to connect to the grid until delivery routes are determined in the morning. Such uncertainty makes it difficult for the aggregator to bid into the day-ahead market. Therefore, the aggregator has the choice of participating with lower bound forecast prediction, rather than their most probable generation prediction, or be held to potentially expensive risk of real time market purchases if their prediction is off. This effectively limits the aggregator from offering the full potential of the DER resources.

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[13] Bach Andersen, Peter, et al. "The Parker project: Cross-brand service testing using V2G." *World Electric Vehicle Journal* 10.4 (2019): 66.

[14] Zhang, Cong, et al. "Quantifying the benefits of electric vehicles on the future electricity grid in the midwestern United States." *Applied Energy* 270 (2020): 115174.

[15] R. Fonteijn, T. Van Cuijk, P. H. Nguyen, J. Morren and J. G. Slootweg, "Flexibility for congestion management: A demonstration of a multi-mechanism approach," *2018 IEEE PES Innovative Smart Grid Technologies Conference Europe (ISGT-Europe)*, 2018, pp. 1-6, doi: 10.1109/ISGTEurope.2018.8571896.

[16] Nuvve. “Giving Second Life to EV Batteries” Available at: https://nuvve.com/giving-used-batteries-a-second-life/

One solution proposed is to increase opportunities for all asset types to rebalance closer to real-time by offering into an intraday market. [17] These markets, which are currently operated in various regions in Europe, are often on intervals of 15 to 30 minutes and close 45 minutes to an hour before dispatch. This would allow resources to further incorporate load flexibility as a grid service without imposing burdensome financial risks.

The same principle of designing market rules based on the characteristics of DERs, can be applied to other types of market products such as capacity resources, allowing more time granularity and for more short duration resources to participate.

3) DERs should be valued equally to traditional large-scale resources.

Some RTO/ISOs have taken steps to enable DER participation in their wholesale markets. However, some grid operators have also proposed to significantly reduce the capacity value DERs. These reductions in value are based on modeling assumptions, not actual performance. For example, a storage resource would only receive 75% value in the NYISO markets once there are 1,000 MW of incremental Energy Limited Resources (including storage). This 75% value would apply even if the storage resource performed perfectly during peak conditions or reliability events. By contrast, a traditional generator would retain close to 100% capacity value even if it did not perform during such periods. Competitive markets should equitably compensate and penalize resources for the value they actually deliver to customers, and not using metrics based on the capabilities of traditional thermal generation.

4) Telemetry requirements should match the service they are providing and aggregated metering by an external entity should be allowed.

Requiring six second telemetry of DERs means that existing metering and sub-metering of DERs, including embedded systems for EV charging stations, energy management systems, and utility smart meters, which can support one-minute or five-minute telemetry, will need to be replaced. This additional meter cost is often too high for DERs to consider participation and is unreasonable given the services they are providing. For example, a one to five-minute telemetry is more than sufficient for day ahead energy markets settled on fifteen-minute intervals. Telemetry requirements should be set to match the service the resource is providing and enable the use of existing equipment installed at DER sites. Where a DER is providing regulation services or other services that where six second telemetry is needed, the requirement for metering that meets that need would be retained.

Requiring each DER in an aggregation to be separately metered with an ISO grade meter is extremely expensive, on the order of up to $3000 a meter. Therefore, even if telemetry requirements are lowered for certain grid services, the cost of installing metering of every resource prevents aggregators from developing a viable business case. Further, the impact of a small DER such as a battery not performing is unlikely to impact the overall performance of the

[17] Newman, Jonathan, and Pamela MacDougall. "Increasing DER integration through discrete intraday settlements." *The Electricity Journal* 34.4 (2021): 106932.

resource or impact the broader system. Allowing the metering to be aggregated by the aggregator scheduling operator or a third-party entity, as is done in CAISO,[18] enables DERs to participate without the burden of overly prescriptive telemetry costs.

5) Remove restrictive entry barriers and requirements for DERs

RTO/ISO markets can have overly prescriptive entry and exit requirements which prevent DERs from participating. The following reforms should be considered:

- *Ease limitations on size and duration.* Entry requirements which have minimum volume requirements, e.g. >1 MW, or only allow long duration resources, e.g. > 4 hours, to participate prevent most newly electrified resources and DERs from participating.

- *Ensure aggregated DR resource types can participate in wholesale markets.* While Order no. 2222 has opened wholesale markets to DERs by allowing heterogenous aggregations to participate, demand resources may still be limited. For example, EVs which are used for managed charging only, without bi-directional charging, could still be subject to state opt out rules. Aggregations, comprised solely of DR resources, should not be prevented from participating in wholesale markets.

- *Allow aggregations beyond just a single node.* Aggregation must be permissible across nodes. For example, to participate as a capacity resource in NYISO, resources in an aggregation must be located under a single node. However, capacity is procured at a zonal level. Depriving aggregators the ability to aggregate more broadly for capacity resources will reduce the amount of megawatts participating in the market and negatively impact competition and reliability.

- *Set entry and exit fees for DERS which are not prohibitive.* For small aggregators and DERs, high entry and exit fees prevent their ability to participate in the wholesale markets. For DERs, fees should be minimized and reflective of the size of the resource participating.

6) Transmission-distribution operational coordination is necessary.

The absence of a framework for transmission-distribution operational coordination, and a resolution for tier bypassing, also prevent proper dispatch of DERs on the bulk system. RTOs should be investing in systems to automate coordination between the transmission and distribution systems to effectively use flexible resources as a grid service.

[18] See California Independent System Operator, Inc., Business Practice Manual for Direct Telemetry Version 12.0, beginning at p.46, available at https://bpmcm.caiso.com/Pages/BPMDetails.aspx?BPM=Direct%20Telemetry

Again, I greatly appreciate the Commission’s initiation of this and future technical conferences and its commitment to improving market design to enable inclusion of newly electrified resources as an asset in a modernized grid.